Full Depth Reclamation

Using Cement Stabilization

We've come a long way…

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Disclaimer:

- Information in this presentation is based on my experience and is my opinion only. There are different methods that are equally acceptable.

- Information shown for cement stabilization can be applied to asphalt stabilization applications as well. Applies to County force construction or contracted conduction.

Why Full Depth Reclamation (FDR)

- Reuse Existing Roadways Materials
- Cost Effective
- Increased Structural and Durability as Compared to Unbound Granular Bases
- Fast Construction
- Maintain Traffic During Construction

- Cement Treats Wide Variety of Soil Types, Emulsions Limited to Gravels and Sands

A 25 Year Perspective
Our Evolution of FDR

- 1994: Rehab IH 820 Frontage Road (TxDOT Design)
- 1996: FM Roadway Rehabilitations (TxDOT Design)
- 2000 – 2006 Tarrant County Roadways
  - Bonds Ranch Road
  - Willow Springs, Road Repairs & More…
- 2006 – 2014: The Barnett Shale Roadway Massacre (TxDOT Maintenance)
- 2014 – Present: Tarrant County & City Streets
  - Average 26-28 Lane Miles Annually

Early Projects - IH 820 Frontage Road (1994)

- Rehab in 1994
- 8” Cement Stabilized Base (600 psi)
- Seal Coat, then HMAC Surface
- 10,000 Vehicles Per Day
- No Major Failures, Replaced in 2014

Early Projects – Willow Springs Road (2004)

Willow Springs Road

4% Cement Recycled w/ 6”Limestone Flex Base

Seal Coat w/ HMAC Surface 1Yr Later

Early Projects – Bonds Ranch Road (2002)

10” Limestone FlexBase w/ 3.5% Cement (Pug Mill)

2 inch HMAC Surface

CTB Is Processed at the Pug Mill and Delivered. Placement of the CTB is Accomplished with a

Jersey Spreader.

Average 28 + Day Compressive Strength 460 psi

3 Years Later

Bonds Ranch Road (2020)

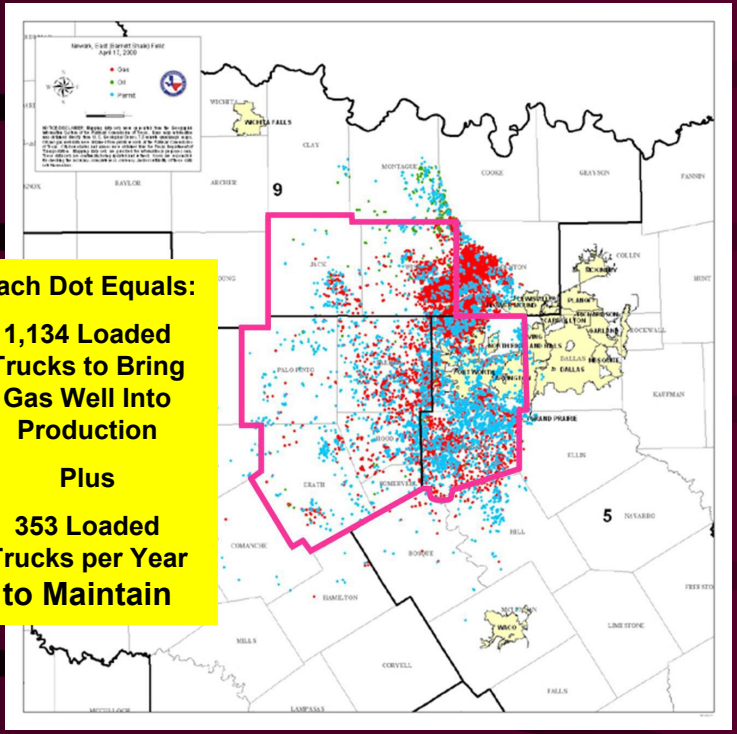
- Originally Constructed in 2002
- 10 in Cement Treated Flexbase w/ 2 in HMAC Surface
- Approx 6000 new Homes In Area
- Approx 16,000 ADT (20% Trucks)
- Truck Cut Though Route

City Portion
Minimal Preventative Maintenance
Original Surface (18 years old)
Solid with a Few Isolated Failures

Average 28 + Day
Compressive Strength
460 psi

County Portion
Regular Prev Maint (Crack Sealing)
Asphalt Overlay in 2016

Barnett Shale Road Massacre



Each Dot Equals:

1,134 Loaded Trucks to Bring Gas Well Into Production

Plus

353 Loaded Trucks per Year to Maintain

Cement Stabilization Used Extensively to Restore Roadways

Maintenance Repair:

Bomag 4% Cement into Existing Base, Cap with HMAC

10 In CTB w/ 2 " HMAC Cap

Construction Method

Mix in Cement, Pull Out Material (Wind Row), Place Back in Lifts & Water Each Layer

Rehabilitating Deteriorated Pavements with Cement

- Pulverize Existing Roadbed
- Mix In Cement (Dry Bulk or Slurry)
- Add Water and Remix
- Compact
- Blade and Roll
- Water Cure
- Micro-Crack and Prime
- Resurface

Equipment Required:

Reclaimer
Water Truck
Motor Grader
Compactor
Pneumatic Roller
Steel Wheel Roller

Cracks
Don't Be Too Quick to Judge

- Underlying Soils
- Edge Cracking
- Thermal Cracking
- All Granular Bases are Going to Crack (Cement/Lime/Nothing)

BUT

Cement Treated Base Material is less water permeable and less prone to pump out fines

Not Reflective Cracking

How to Control Cracking

- **LIMIT CEMENT CONTENT**
  - 250 - 300 psi 7 day Unconfined Compression Strength
  - 3- 4.5 % by weight (Add 0.5 % for field conditions)
- **CONTROL MOISTURE**
  - Uniform Moisture to avoid shrinkage cracking
    - Inject Water into Mixing Bonnet
- **HOMOGENEOUS MIXING**
  - Uniform Cement and Water Distribution in Mixture
- **MICRO-CRACKING**
  - 24-72 hours: Three Full Passes, High Amplitude
    - Opening to Traffic is NOT Micro-Cracking
- **STRESS RELIEVING LAYER (Opt)**
  - Seal Coat or Unbound Flex Base Layer

Types of Cement Application

- **Bags** for Repairing Small Base Failures

❑ **Pros:**

- **Quick**
- **Spot/Soft Spot Repairs**

❑ **Cons:**

- Expensive
- Small Areas Only
- Labor Intensive
- Uneven Cement Distribution

Types of Cement Application

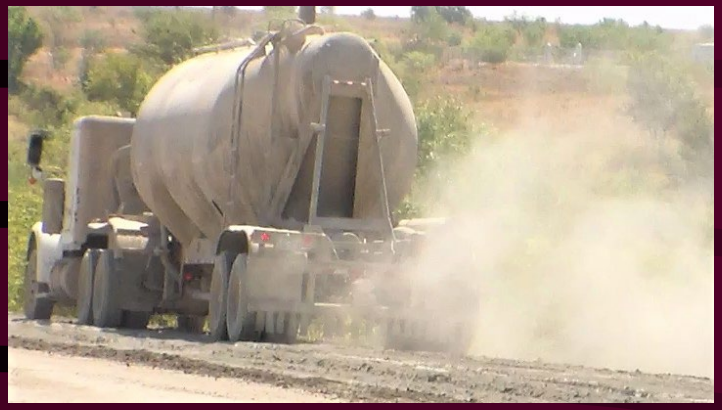
- **Cement Treated Base (Pug Mill)**

- **Pros:**
  - Controlled, Homogeneous Mixture
  - No Mess, Clean Site and Equipment

- **Cons:**
  - Getting Consistent Material Delivery
  - Cost
  - Time Delays

Types of Cement Application

- **Dry Bulk for large RURAL Projects**



- **Pros:**
  - **Fast**
  - **Cheapest Option**
  - **Most Available Option**

- **Cons:**
  - **DUST**
  - Uneven Application Rate
  - Equipment Issues (Clogged Filters)

Types of Cement Application

- **Slurry Truck (Bar Application)**

❑ **Pros:**

- **No Dust**

❑ **Cons:**

- Prep Work (Pre-Chew, Windrows, Berms)
- Uneven Application Rate
- **Messy**

Types of Cement Application

- **Slurry Truck (Injection Application)**

My preference for ALL projects
Homogenous Slurry, 55% solids suspension, 4 hours application & NO DUST

❑ **Pros:**
- **No Dust**
- **Even, Homogeneous Application**
- **No Mess, Clean Site and Equipment**
- **Quick Re-Entry to Drives and Streets**

❑ **Cons:**
- **Slurry May Not be Available Everywhere**

Types of Water Application

- **Water Truck (Bar Application)**

- **Pros:**
  - **Quick**
- **Cons:**
  - **No Control**
  - **Uneven Application, Both Laterally and Depth. Wet/Dry Areas**
  - **Messy**

Types of Water Application

- **Injection (Reclaimer)**

- **Pros:**
  - Superior Moisture Control
  - Even, Homogeneous Distribution
  - Clean Construction
- **Cons:**
  - A Little More Time Consuming

Our (New) Go To Method

Typical Scope: 8” Stabilization, 4” HMAC
Reclaim and Inject Slurry (12”), Inject Water.
Mill excess Materials (4”) Afterwards

- **Pros:**
  - **No Prep Work, No Dust**
  - **Recycle your Best Materials**
  - **Road Remains at Grade Most of Project**
  - **Fast Re-Entry to Drives and Streets**
  - **Rain Insurance**
  - **Even, Homogeneous Application**
  - **No Mess, Clean Site and Equipment**
  - **Post Milling Gives Better Grade Control**

Design Considerations for Success

- Sample Cores
- Reference Designs
- Incorporate as Much RAP/ Exist Base as Possible
  - Up to 50% RAP
- Increase Cross Slope to Account For Fluff (3%)
- Step Construction (Reinforce Roadway Edges)
  - 26 ft Stab Base; 25 Ft Asph Binder; 24 Ft Surface
- New Construction (50% Flex Base / 50% RAP)
- Expect 20+ Years Design Life from Stabilized Base
  - Two Surface Cycles

Construction Considerations

- Pothole Utilities, Video Project (esp. Driveways)
- Pre-Chew Road Surface
  - No Surprises when scarifying or Mixing (Deep Repairs, Utilities)
  - 4” quick chew for Windrows
- Construct Windrows & Berms
- Lay Out Slurry Orders (28-32# / Sy) (15 tns =700 lf x 13 ft)
- Linear or Side x Side Placement
- Drop Drum to Allow for Fluff
- Trim (Tight Blade) Only. DO NOT FILL on Surface
- Proof Roll, Micro-Crack and Prime
- Water to Control Dust & Cure
- Use Leveling Bar on Laydown Machine
- Backfill Edges

More Construction Considerations

Pull Materials from under Windrows and Adjacent to Curbs

Problems to Look Out For

Irrigation Systems
Manholes, Valves, etc
Shallow Structures

Traffic Control Considerations

Performed Under Traffic and Open to Traffic Daily

- Limited work Hours 8:30 am to 3:00 pm
  - ❖ Flag One Lane One Way (Two Way Traffic)
  - ❖ One Way Traffic with Detour (Maintains Access)
  - ❖ Full Closure – Doubles Production (60 tons)
- Roadway Open During Non-Work Hours
  - ❖ Control Moisture/Dust
  - ❖ Sandy Soil - Soil Cement may require to keep heavy traffic off for 24 hours

Typically, What Can You Expect?

Road Section: 4 in HMAC w/ 8" Cement Treated Base

- Based on Maintaining 2 Way Traffic, Open to Traffic Daily
- Construction Expectation: ½ mile per 2 weeks (complete)

Schedule:

- Mon – Mill or Pre-Chew
- Tues- Friday: Stabilize, Micro-Crack, Tight Blade Prime (Two Linear Loads, 30 tons day)
- Use the Weekend for Curing Time
- 2nd Monday, Tight Blade, Prime, Prep (Manholes)
- Tues – Thurs: Pave

Questions

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